Pollution Prevention
Technology Application Analysis Template

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DISCLAIMER

This document is designed to assist the user in analyzing the application of pollution prevention technologies. While it provides a template for the general types of questions that you should ask when evaluating a P2 technology, it may not include all of the questions that are relevant to your business, or which your business is legally required to ask.

This document is not an official U.S. EPA or Army Corps of Engineers guidance document and should not be relied upon as a method to identify or comply with local, state or federal laws and regulations. EPA and the Army Corps of Engineers has not examined, nor do they endorse, any technology analyzed using this template.

Introduction

The purpose of technology application analyses is to summarize the results of utilizing new and innovative pollution prevention technologies in a full scale commercial application and to assist in their commercialization. This technology application analysis template is designed to assist vendors of pollution prevention technologies in developing their own technology application analyses.

The template serves as guidance for characterizing in a concise manner, the main features of the technology, its benefits, the costs associated with its implementation, regulatory aspects, and lessons learned from the application experience. For brevity, the designation “P2" is used for “pollution prevention”. This template is not intended to suggest that a vendor should limit the information provided to a potential user of a pollution prevention technology. Additional information beyond that suggested in this template, may be useful and should be made available.

The intent of the Environmental Protection Agency is to promote the use of technology application analyses as a method of promoting and accelerating the introduction and use of new pollution prevention technologies.

This template is divided into seven sections:

- Introduction
- Description of P2 Technology
- P2 Technology Application
- P2 Technology Performance
- Cost Information
- Regulatory / Safety Requirements
- Lessons Learned / Implementation Issues

Description of P2 Technology

The following section describes the P2 technology. The P2 technology is described, giving general information on the major processing units, feed influent and product effluent, and energy / utility requirements. The applicability of this technology to industry is described. The advantages and limitations in applying this technology are also given in this section.

Technology Description

Overview

This section should introduce the P2 technology and provide the following information:

- General description of technology
- Description of the innovative portion of the technology (new catalyst, different construction materials, novel design configuration, automated controls)
- Technology processing capacity (or range)
- Patents associated with this technology (is patent pending?)

Detailed Description

A detailed description of the P2 technology may consist of all or part of the following items:

- *Process Schematic* - This section will include a simplified schematic diagram of the P2 technology process. The schematic should show major process equipment and material flows in and out.

- *Process Description* - A brief characterization of the technology should be provided which describes the core chemistry (if applicable), processing steps, major equipment, and inputs / output streams shown in the schematic above. The principal operating conditions required for this technology should also be included (e.g.,temperatures and/or pressures that must be maintained in particular processing units during operation).

- *Simplified Block Diagram (optional)* - This section consists of a simple box diagram which labels the material inputs and outputs to the process. The optional diagram could be used to enhance the reader's understanding of the process by providing supplemental description of the inputs and outputs from the process. This diagram may be particularly useful in those cases where either numerous process steps are involved or if the vendor desires the technology to be proprietary.

If not shown in the process schematic above, this simplified diagram should show the following: liquid streams, solid streams, and gas streams. Examples of relevant materials/streams include: raw materials, chemicals, fuel, process water, rinse water, treatment reagents, electricity, and cooling water. Outputs should distinguish between product and by-product materials. Miscellaneous solid waste streams (such as absorbents, spent filters, residues, etc.) should be indicated on the diagram. Miscellaneous air emissions (such as vapors and mists) should also be indicated on the diagram. The source of these air emissions (such as process baths, spills, samples) should be clearly stated.

- *Material Balance Description (optional)* - This section provides text associated with the above simplified block diagram describing the input and output streams. If not already presented in the process description above, the material balance description should provide additional feed characterization as available including: typical composition of feed, specific chemical / additive requirements, and the chemical and physical characteristics of each waste stream. This material balance description should account for all material inputs (e.g., solvents) and output streams including the losses, product, inventory, and/or wastes from the process.

Technology Applicability

This section describes the applicability of this technology to users, the development history, and the advantages/limitations claimed by the technology vendor.

Applicability to Industry/User

This section should list both advantages and limitations claimed by the technology vendor. The advantages should focus on pollution prevention benefits derived from technology implementation. Other items that may be discussed include:

- Type of industrial process in which this P2 technology has been utilized to date.
- P2 goals and objectives (include specific details of waste reduction in reference to traditional technology, i.e., percent reduction, type of waste reduction, treatment avoided, waste stream eliminated)
- Other potential applications for this technology (by product or industry)

Development / Application History

The technology development history should be presented in chronological order. The following information is suggested:

- Locations of technology applications
- Date of completion of technology development
- Design capacity of each application
- For commercial applications, the longest continuous run time with explanation of reason for run time termination is of interest

Table formats may be especially helpful in organizing this information. For example, the following table format may be used to describe each major development phase and applications of the technology:

Year	Location	Scale	Capacity	Longest Continuous Run	Reason for Run Termination
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-

If available, an additional table may useful to list contacts and references at the application sites listed above.

Lessons Learned During P2 Technology Development

The general lessons learned during the development of this process would be of considerable interest to a prospective user.

P2 Technology Application

The following section describes the use of the P2 technology at a specific application site and/or location. This section will further describe the details of the P2 technology location within the plant and how the plant production / operation was affected.

P2 Technology Application

General Setting

- Description of process/plant/manufacturing plant in which this P2 technology was applied
- P2 goals and objectives for this application (include specific details of waste reduction in reference to traditional technology, i.e., percent reduction, type of waste reduction, treatment avoided, waste stream eliminated)
- Benefits and/or advantages demonstrated by this application, if applicable

Technology Implementation At Manufacturing / Industry Plant Site

This section will give a diagram showing where the P2 technology fits within the context of the host plant in which it has been applied. The location within the manufacturing plant may be a block flow diagram of the overall plant system. A block diagram of each plant system should include all major equipment included in the manufacturing process.

This discussion should present a text which supports the above plant schematic. It could include a brief description of where the technology application fits in the process at the host plant and its proximity to other process links. If applicable, this discussion should also present the traditional technology that is replaced by the P2 technology and the reasons for use of the P2 technology.

P2 Technology Performance

This section will present performance data for the P2 technology as a result of an actual application. This section should give the P2 technology performance goals in this application. The technology's performance in the selected application is described by summarizing the application runs made and the performance achieved.

P2 Performance Goals

This section will present the major pollution prevention goals of the P2 technology which determine the basis for performance evaluation. These parameters may include the following (when applicable):

- Percent wastewater discharge volume reduction
- Percent recycle (materials recycled onsite)
- Percent materials recovered for offsite recycling
- Reduction in usage of raw materials (source reduction)
- Percent reduction in utilities consumption (i.e., cooling water, electricity, rinse water)
- Percent reduction in residue/sludge requiring disposal
- Increased process/rinse efficiency
- Percent reduction in vapor/gaseous/fugitive dust/air emissions
- Increased life extension of operating components
- Reduction in product rejection rate
- Percent metals recovered
- Percent decrease in treatment chemical usage
- Improvement of reclaimed or recycled solvent purity
- Increased reuse of process batches

Technology Application Test Cases

For technology application where the pollution prevention technology is not permanently installed for commercial operation but is a temporary demonstration of commercially applying a new P2 technology, this section should provide a description of the tests which were run using the P2 technology.

This description should include details regarding the input materials or waste stream [identifying specific chemicals of concern (COCs)] that are either reduced or eliminated]. The duration of the test and the range of process conditions (such as feed variability, temperature, and pressure) should also be listed. The application and/or test cases should be summarized in table form as shown below.

Test Case Number	Input Rate (lb/hr)	Chemical Usage (lb/hr)	Run Duration (hours)	Key Variables (Temp, Press) (°F, psi)
-	-	-	-	- -
-	-	-	-	- -
-	-	-	-	- -

Text associated with this table should discuss the relevance of the information provided and the units used for reporting this information.

P2 Technology Application Results

This section presents the performance of each application run, giving key results such as energy balance data. This discussion of performance should address the P2 goals discussed in the previous section.

The characterization of the waste generated by the technology should also be summarized here. In situations where a conventional technology has been previously identified or where the host plant operated with another technology, a table format may be used to summarize waste production and compare the waste produced by another technology to the waste produced utilizing the P2 technology.

	---------- P2 Process ----------		**-------- Previous Process -------**	
Description	Waste #1	Waste #2(etc.)	Waste #A	Waste #B(etc.)
Rate (lb/hr)	-	-	-	-
Composition:				
- constituent #1	-	-	-	-
- constituent #2	-	-	-	-
- constituent #3	-	-	-	-
- constituent #4	-	-	-	-
- constituent #5	-	-	-	-
- constituent #6	-	-	-	-
Temperature (°F)	-	-	-	-
pH	-	-	-	-
Sp Gr.	-	-	-	-
Viscosity (cp)	-	-	-	-

Note: If the process involves more than 2 wastes, a column should be added for each waste.

The waste described in the above table should be correlated with the associated test case number and rate of flow presented in the preceding section.

The treatment/disposal/recycling method used for residual wastes from this technology application should also be summarized here.

Performance Compared to Existing/Traditional Technology

Where applicable, a comparison of the traditional technology and the P2 technology should be provided. This comparison may be put in text or tabular form and should address as many of the following parameters as possible:

- Productivity (yields)
- Product quality (note if there are changes - improvements or deterioration)
- Raw materials required (types and quantities of solvents, surfactants, acids, bases, salts, etc.)
- Utility requirements (cooling water, steam, electric power)
- Wastewater, solid waste, and air emission discharges (includes rinse water, steam condensate, blowdown water, exhaust scrubber solution, spent baths, sludges from wastewater treatment, solvents used for degreasing, solvent vapors, mists, etc.)
- Improved rinse efficiency
- Volume of waste sent to offsite recycling.

Cost Information

This section will present cost information associated with the design, construction, startup, and operation of the P2 technology. This discussion should provide the name of the company supplying the information presented and the costs estimated in current US dollars.

Capital Costs

This section will include itemized costs associated with equipment and installation required for implementation of the P2 technology in this application. The capital costs discussed should apply to the majority of the market in which the technology is used. Tabular presentation of the following cost parameters for this specific application could include: direct costs based on materials (equipment cost), infrastructure change requirements, installation labor, plant down time, etc.

For technology applications which require periodic investment cost to occur at scheduled intervals, it is recommended that the present value of these future investments be given.

Operating Costs

This section will include itemized operation and maintenance tasks and associated costs required for the use and operation of the technology in this application. Tabular presentation of the following cost items (to the extent that this information is available) from the actual application could include:

- labor including training and license requirements for supervisors and operators (using fully burdened rates)
- utilities and special provisions (e.g., electricity, fuel, steam, water, air, space requirements, fire protection, safety requirements, onsite laboratory requirements)
- training expenses
- maintenance costs
- waste handling and sludge disposal costs
- materials (raw materials, additives, cleaning and wetting agents, chemicals) costs
- monitoring costs
- permitting expense
- insurance (health/liability) expense
- depreciation charges
- water and sewer expenses

Quantity and unit costs may be indicated separately in tabular form.

For technology applications which require operating expenditures on greater time intervals than yearly, an annualized cost should be presented, if possible. For cases where time value of money calculations are done, a vendor may choose a standard discount rate indicative of inflation.

Where applicable, a text discussion should compare the relative costs associated with the use of traditional technology versus the P2 technology used in the case study. This comparison should include traditional costs avoided, and new costs incurred. Changes in the individual components of operating costs (traditional technology versus P2 technology) may be shown in tabular form.

Cost Benchmarks

This section will provide details regarding cost benchmarks that illustrate pollution prevention benefits derived from this specific application. These benchmarks are for this specific application and therefore should be based on inputs from the customer of the technology and not generic performance as claimed for the technology by the vendor. The benchmarks that may be discussed include:

- Per unit output (e.g., cost per unit volume or mass of product or raw materials)
- Pay back period (capital cost/change in annual operating costs)
- Return on investment (with key assumptions)
- Benefits cost ratio
- Present value of net benefits
- Percent reduction in disposal costs
- Percent reduction in sewer and disposal fees.
- Percent reduction in waste transportation/treatment/disposal cost.
- Percent final cost savings.

Regulatory/Safety Requirements

This section will provide information regarding the regulatory requirements related to the implementation of the P2 technology system.

Applicable Regulations

This section should present any regulations that apply to the implementation of the P2 technology. In many cases, it is expected that state and municipal regulatory authorities would handle most permitting activities. Included is a preliminary list of potentially applicable regulations and the regulatory authority responsible for its administration.

- Clean Air Act (US Environmental Protection Agency, state)
- Clean Water Act (US Environmental Protection Agency and specific state environmental agency, state, local)
- Occupational Safety and Health Administration (US Department of Labor)
- Resource Conservation and Recovery Act (US Environmental Protection Agency, state)
- Toxic Substances Control Act (US Environmental Protection Agency, state)
- Emergency Preparedness and Community Right-To-Know Act (US Environmental Protection Act, state)

This section should give a brief description of the applicable regulations and how they apply.

Permit Requirements

As part of the permitting effort for a given application, a regulatory assessment is often made by regulatory authorities, determining the details of the permitting strategy to satisfy the applicable regulations summarized above. This permitting strategy usually addresses the mitigation of potential impacts to air and water. A strategy to comply with hazardous waste related regulations is also usually needed. A descriptions of the permitting pathway followed to comply with Federal and state regulations is discussed here. For this discussion, the following items may apply:

- Hazardous waste management - exemptions from permitting, hazardous waste identification of wastes, generator registrations required, type of containers and storage required, and/or the need for licensed hazardous waste transporter.

- Water - NPDES requirements, Clean Water Act requirements, discharge limits required to meet pretreatment requirements before municipal wastewater treatment plants, sewer connection permit requirements, and/or groundwater discharge permit requirements.,
- Air - registration with the state quality air program, exemptions qualified for, permitting requirements, and/or discharge limits imposed.

This section should present a comparison of the permits required for implementation of the traditional versus the P2 technology. This information can be presented in the form of a table or as text which identifies the changes or elimination of permit requirements between the two technologies.

Regulatory Interaction

This section should identify waiting times required for permits and formal approvals required from regulators required for the implementation of the P2 technology. The timeline for permitting this application is of considerable interest to prospective users. A bulleted list in chronological order is recommended to display this information.

Permitting issues which caused unusual long delays in the permitting timeline (such as regulatory review and approval of plans) should be explained, giving the type of problem encountered and how it was resolved.

Health/Safety Issues

List here the safety issues associated with the technology application or the avoidance of safety issues as a result of using this technology:

- increase or decrease in risk for workers, if any (such as health, fire, explosion, leak, spill related). Particular focus on the elimination or introduction of risk issues would be of interest.
- need for operator safety training
- incidences of spills and leaks, if any
- decrease in the number of safety issues that must be handled during technology operation.

Lessons Learned/Implementation Issues

The case study provided in this document is based on a P2 technology applied at a specific site. Lessons learned in both design and operations areas should be derived from information provided by the technology vendor and the user at the site where the specific technology was applied.

Following are examples of typical types of lessons learned, that may be mentioned in this section:

Design Issues

Issues related to the design of the technology/equipment should be listed here. Such items may include:

- excess capacity requirements (infrastructure / utility requirements, spare capacity)
- corrosion allowances
- special control automation required
- floor layout space requirements (including warehouse, administrative, production space)
- difficulty or lack of difficulty in reaching successful startup condition.

Implementation Considerations

Based on experience with this technology application, lessons learned relative to future implementation of the technology are listed here. Such items may include:

Labor Related:
- additional and/or specialized operator training required, if any

Maintenance Related:
- maintenance required and frequency
- specialized maintenance requirements and/or maintenance problems
- additional work space needed (height, area, and weight)
- spares required

Implementation Related:

- expected production plant disruption (times and duration), if any
- installation issues (such as indoor/outdoor requirements)
- equipment delivery times
- the effect of different operating modes on nature of product
- for batch and semi-batch processes, items (such as positioning of work piece, residence time, contact times, drain times, recycle rates, etc.)
- effect on base plant
- disposal of replaced equipment

Benefits Derived From Application

This section will present a list of issues that were identified by the P2 technology user as benefits as a result of installation and implementation of this technology.

Limitations In Application

This section will present key issues that were identified by the manufacturer as limitations to the user as a result of installation and implementation of this technology.